t_{RM} (234)

temperature sensing circuitry for generating a temperature process value;

t_{SP} (246

setpoint determining circuitry for establishing a temperature setpoint;

444

airflow signal circuitry for generating an airflow setpoint in response to said temperature t_{RM} process value and said temperature t_{SP} setpoint;

454 PV 96

flow sensing circuitry for generating a flow process value in response to a predetermined set of flow sensing FROM 18 inputs; and

464-452

damper control circuitry for generating a damper motor Q_{ACT} operation signal to control the damper motor in response to Q_{SP} said flow process value and said airflow setpoint, said damper control circuitry comprising a fuzzy logic control mechanism for implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal.

FUZZY LOGIC

2. The controller of Claim 1, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, said flow sensing circuitry, and said damper control circuitry are formed sufficiently small for placement on a single printed circuit board, said printed circuit board formed for placement on the damper motor when said damper motor is installed in the damper shaft.

3. The controller of Claim 1, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, and said flow sensing circuitry

operate under an open protocol that permits system-wide control and monitoring of said controller within said variable air volume air conditioning system.

4. The controller of Claim 1, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, and said flow sensing circuitry are associated to permit pressure dependent operation of said controller.

5. The controller of Claim 1, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, and said flow sensing circuitry are associated to permit pressure independent operation of said controller.

6. The controller of Claim 1, wherein said controller further comprises circuitry for permitting a fire mode of operation for said variable air volume terminal.

7. **(CANCEL)**

8. The controller of Claim 1, further comprising circuitry for permitting remote control of said controller for controlling operation of said variable air volume terminal.

9. **(CANCEL)**

10. **(CANCEL)**

11. **(CANCEL)**

12. **(CANCEL)**

13. **(CANCEL)**

14. **(CANCEL)**

~~15. A method for controlling a variable air volume terminal, having a damper and a damper motor, comprising the steps of:~~

~~generating a temperature process value using temperature sensing circuitry;~~

~~establishing a temperature setpoint using setpoint determining circuitry;~~

~~generating an airflow setpoint in response to said temperature process value and said temperature setpoint using airflow signal circuitry;~~

~~operating said variable air volume terminal in a warm-up mode of operation~~

~~generating a flow process value in response to a predetermined set of flow sensing inputs using flow sensing circuitry; and~~

~~generating a damper motor operation signal using damper control circuitry to control the damper motor in response to said flow process value and said airflow setpoint, said damper~~

motor operation signal generating step further comprising the step of implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal.

16. The method of Claim 5, further comprising the step of forming said temperature sensing circuitry, said set point determining circuitry, said air flow signal circuitry, said flow sensing circuitry, and said damper control circuitry sufficiently small for their placement on a single printed circuit board, said printed circuit board formed sufficiently small for placement on the damper motor when said damper motor is installed in the damper shaft.

17. The method of Claim 15, further comprising the step of operating said temperature sensing circuitry, said set point determining circuitry, said air flow signal circuitry, and said flow sensing circuitry under an open protocol that permits system-wide control and monitoring of said controller within said variable air volume air conditioning system.

18. The method of Claim 15, further comprising the step of associating said temperature sensing circuitry, said set point determining circuitry, said air flow signal circuitry, and said flow sensing circuitry to permit pressure dependent operation of said controller.

19. The method of Claim 15, further comprising the step of associating said temperature sensing circuitry, said set

point determining circuitry, said air flow signal circuitry, and said flow sensing circuitry to permit pressure independent operation of said controller.

20. The method of Claim 15, further comprising the step of permitting a fire mode of operation for said variable air volume terminal.

21. **(CANCEL)**

22. The method of Claim 15, further comprising circuitry for permitting remote control of said controller for controlling operation of said variable air volume terminal.

23. **(CANCEL)**

24. **(CANCEL)**

25. **(CANCEL)**

26. **(CANCEL)**

27. **(CANCEL)**

28. **(CANCEL)**

29. A variable air volume air conditioning system, comprising:

a controller for a variable air volume terminal;

a variable air volume terminal comprising a damper, a damper motor associated to move said damper, and a terminal controller for controlling operation of said damper motor, said terminal controller comprising:

temperature sensing circuitry for generating a temperature process value;

setpoint determining circuitry for establishing a temperature setpoint;

airflow signal circuitry for generating an airflow setpoint in response to said temperature process value and said temperature setpoint;

flow sensing circuitry for generating a flow process value in response to a predetermined set of flow sensing inputs; and

damper control circuitry for generating a damper motor operation signal to control the damper motor in response to said flow process value and said airflow setpoint, said damper control circuitry comprising a fuzzy logic control mechanism for implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal.

30. The system of Claim 29, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, said flow sensing circuitry, and said damper control circuitry are formed sufficiently small

for placement on a single printed circuit board, said printed circuit board being formed for placement on the damper motor when said damper motor is installed in the damper shaft.

31. The system of Claim 29, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, and said flow sensing circuitry operate under an open protocol that permits system-wide control and monitoring of said controller within said variable air volume air conditioning system.

32. The system of Claim 29, wherein said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, and said flow sensing circuitry are associated to permit pressure dependent operation of said controller.

33. The system of Claim 29, wherein said temperature sensing circuitry, said set point determining circuitry, said air flow signal circuitry, and said flow sensing circuitry, are associated to permit pressure independent operation of said controller. O.N.

34. The system of Claim 29, wherein said controller further comprises circuitry for permitting a fire mode of operation for said variable air volume terminal.

35. **(CANCEL)**

36. The system of Claim 29, further comprising circuitry for permitting remote control of said controller for controlling operation of said variable air volume terminal.

BE

37. **(CANCEL)**

38. **(CANCEL)**

39. **(CANCEL)**

40. **(CANCEL)**

41. **(CANCEL)**

42. **(CANCEL)**

43. A controller for an environmental control system, comprising:

temperature circuitry for receiving a signal representing a temperature process value;

setpoint circuitry for receiving a signal representing a temperature setpoint;

demand signal generating circuitry for generating a demand signal in response to said temperature process value and said temperature setpoint;

flow sensing circuitry for generating a flow process value in response to a predetermined set of flow sensing

inputs; ~~and~~

~~flow medium control signal generating circuitry for generating a flow medium control signal to control an actuator in response to said flow process value and said demand signal, said flow medium control signal generating circuitry comprising a fuzzy logic control mechanism for implementing a set of fuzzy logic rule-based instructions in generating said flow medium control signal.~~

~~44. The controller of Claim 43 wherein the flow medium control signal generating circuitry is operable to generate a flow medium control signal to an actuator, such that the flow medium control signal represents an offset, and wherein said offset represents an incremental move of the actuator.~~

~~45. The controller of Claim 43 wherein the flow medium control signal generating circuitry is operable to generate a flow medium control signal to an actuator, such that the flow medium control signal represents instructions to the actuator to move the actuator from a first position to a second position.~~

~~46. A method for controlling an environment, comprising the steps of:~~

~~receiving a signal representing a temperature process value;~~

~~receiving a signal representing a temperature setpoint;~~

~~generating a demand signal in response to said~~

temperature process value and said temperature setpoint;

generating a flow process value in response to a Predetermined set of flow sensing inputs; and

generating a flow medium control signal to control an actuator in response to said flow process value and said demand signal, said flow medium control signal generating step further comprising the step implementing a set of fuzzy logic rule-based instructions in generating said flow medium control signal.

47. The method of Claim 46 wherein the flow medium control signal generating step comprises generating a flow medium control signal to an actuator, such that the flow medium control signal represents an offset, and wherein said offset represents an incremental move of the actuator.

48. The method of Claim 46 wherein the flow medium control signal generating step comprises generating a flow medium control signal to an actuator, such that the flow medium control signal represents instructions to the actuator to move the actuator from a first position to a second position.

Add the following new claims:

a1 I

43
~~49.~~ (NEW) **A controller for a variable air volume terminal, of a variable air volume air conditioning system, comprising:**

I

a1

temperature sensing circuitry for generating a temperature process value;

setpoint determining circuitry for establishing a temperature setpoint;

airflow signal circuitry for generating an airflow setpoint in response to said temperature process value and said temperature setpoint;

flow sensing circuitry for generating a flow process value in response to a predetermined set of flow sensing inputs; and

damper control circuitry for generating a damper motor operation signal to control the damper motor in response to said flow process value and said airflow setpoint, said damper control circuitry comprising:

a fuzzy logic control mechanism for implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal; and

circuitry for automatically stopping movement of the damper at a control stop position for the damper.

44 ~~50~~. (NEW) The controller of Claim 43 ~~49~~, further comprising circuitry for permitting a warm-up mode of operation for said variable air volume terminal.

45 ~~51~~. (NEW) The controller of Claim 43 ~~49~~, wherein said damper control circuitry further comprises circuitry for automatically calibrating the damper stroke of the damper in the variable air volume terminal.

I

46 ~~52~~. (NEW) The controller of Claim 43 ~~49~~, wherein said damper control circuitry further comprises circuitry for manually driving the damper of the variable air volume terminal.

47 ~~53~~. (NEW) The controller of Claim 43 ~~49~~, further comprising Hall Effect circuitry for identifying and controlling operation of said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, said flow sensing circuitry, and said damper control circuitry upon placing a predetermined magnet device proximate said Hall Effect circuitry.

48 ~~54~~. (NEW) The controller of Claim 43 ~~49~~, wherein said damper control circuitry further comprises circuitry for counting alternating current voltage frequencies to said controller and determining from said alternating current voltage cycles the position of the damper in response to operation of said damper motor.

49 ~~55~~. (NEW) The controller of Claim 43 ~~49~~, further comprising a shield surrounding said flow sensing circuitry for limiting affects of temperature variations on operation of said flow sensing circuitry.

50 ~~56~~. (NEW) A method for controlling a variable air volume terminal, having a damper and a damper motor,

A1

comprising the steps of:

generating a temperature process value using temperature sensing circuitry;

establishing a temperature setpoint using setpoint determining circuitry;

generating an airflow setpoint in response to said temperature process value and said temperature setpoint using airflow signal circuitry;

operating said variable air volume terminal in a warm-up mode of operation

generating a flow process value in response to a predetermined set of flow sensing inputs using flow sensing circuitry; and

generating a damper motor operation signal using damper control circuitry to control the damper motor in response to said flow process value and said airflow setpoint, said damper motor operation signal generating step further comprising the steps of:

implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal; and

automatically stopping movement of the damper at a control stop for the damper.

51 ~~57~~. (NEW) The method of Claim 50 ~~56~~, further comprising the step of operating said variable air volume terminal in a warm-up mode of operation.

I

52 ~~58.~~ (NEW) The method of Claim 50 ~~56~~, further comprising the step of automatically calibrating the damper stroke of the damper in the variable air volume terminal.

a1

53 ~~59.~~ (NEW) The method of Claim 50 ~~56~~, further comprising the step of manually driving the damper of the variable air volume terminal.

54 ~~60.~~ (NEW) The method of Claim 50 ~~56~~, further comprising the step of identifying and controlling operation of said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, said flow sensing circuitry, and said damper control circuitry by placing a predetermined magnet device proximate a Hall Effect circuit of the controller.

55 ~~61.~~ (NEW) The method of Claim 50 ~~56~~, further comprising the step of counting alternating current voltage frequencies to the controller and determining from the alternating current voltage cycles the position of the damper in response to operation of the damper motor.

56 ~~62.~~ (NEW) The method of Claim 50 ~~56~~, further comprising the step of limiting affects of temperature variations on operation of said flow sensing circuitry using an enclosed shield surrounding the airflow signal circuitry.

57

~~63.~~ **(NEW)** <u>A variable air volume air conditioning system, comprising:</u>

<u>a controller for a variable air volume terminal; and</u>

<u>a variable air volume terminal comprising a damper, a damper motor associated to move said damper, and a terminal controller for controlling operation of said damper motor, said terminal controller comprising:</u>

<u>temperature sensing circuitry for generating a temperature process value;</u>

<u>setpoint determining circuitry for establishing a temperature setpoint;</u>

<u>airflow signal circuitry for generating an airflow setpoint in response to said temperature process value and said temperature setpoint;</u>

<u>flow sensing circuitry for generating a flow process value in response to a predetermined set of flow sensing inputs; and</u>

<u>damper control circuitry for generating a damper motor operation signal to control the damper motor in response to said flow process value and said airflow setpoint, said damper control circuitry comprising:</u>

<u>a fuzzy logic control mechanism for implementing a set of fuzzy logic rule-based instructions in generating said damper motor operating signal; and</u>

<u>circuitry for automatically stopping movement of the damper at a control stop position for the damper.</u>

58 ~~64~~. (NEW) The system of Claim 57 ~~63~~, further comprising circuitry for permitting a warm-up mode of operation for said variable air volume terminal.

59 ~~65~~. (NEW) The system of Claim 57 ~~63~~, wherein said damper control circuitry further comprises circuitry for automatically calibrating the damper stroke of the damper in the variable air volume terminal.

60 ~~66~~. (NEW) The system of Claim 57 ~~63~~, wherein said damper control circuitry further comprises circuitry for manually driving the damper of the variable air volume terminal.

61 ~~67~~. (NEW) The system of Claim 57 ~~63~~, further comprising Hall Effect circuitry for identifying and controlling operation of said temperature sensing circuitry, said setpoint determining circuitry, said airflow signal circuitry, said flow sensing circuitry, and said damper control circuitry upon placing a predetermined magnet device in proximity to said Hall Effect circuitry.

62 ~~68~~. (NEW) The system of Claim 57 ~~63~~, wherein said damper control circuitry further comprises circuitry for counting alternating current voltage frequencies to said controller and determining from said alternating current voltage cycles the position of the damper in response to operation of said damper motor.

I 63 ~~69.~~ (NEW) The system of Claim 57 ~~63~~, further comprising a shield surrounding said flow sensing circuitry for limiting affects of temperature variations on operation of said flow sensing circuitry.

70. (NEW) The controller of Claim 43, wherein the controller is a variable air volume terminal controller and wherein the environmental control system is a variable air volume air conditioning system.

71. (NEW) The controller of Claim 43, wherein said actuator is a control valve actuator for adjusting the flow of water through a heating coil.

72. (NEW) The controller of Claim 43, wherein said temperature circuitry, said setpoint circuitry, said demand signal generating circuitry, and said flow sensing circuitry operate under an open protocol that permits system-wide control and monitoring of the controller within said environmental control system.

73. (NEW) The controller of Claim 43, wherein said temperature circuitry, said setpoint circuitry, said demand signal generating circuitry, and said flow sensing circuitry are associated to permit pressure dependent operation of the controller.

74. (NEW) The controller of Claim 43, wherein said temperature circuitry, said setpoint circuitry, said demand signal generating circuitry, and said flow sensing circuitry are associated to permit pressure independent operation of said controller.

75. (NEW) The controller of Claim 43, further comprising Hall Effect circuitry for identifying and controlling operation of said temperature circuitry, said setpoint circuitry, said demand signal generating circuitry, said flow sensing circuitry, and said flow medium control signal generating circuitry upon placing a predetermined magnet device proximate said Hall Effect circuitry.

76. (NEW) The controller of Claim 43, further comprising a shield surrounding said flow sensing circuitry for limiting affects of temperature variations on operation of said flow sensing circuitry.

77. (NEW) The method of Claim 46, wherein the environmental control system is a variable air volume air conditioning system.

78. (NEW) The method of Claim 46, wherein said actuator is a control valve actuator for adjusting the flow of water through a heating coil.